CONTEXT FOR RESILIENCY PLANNING

- IS THIS GOING TO HAPPEN MORE OFTEN IN THE FUTURE?
- IF SO, WHAT DO WE DO ABOUT IT?
### Key Climate-Related Vulnerabilities

#### Grouped by SEPTA Functional Areas

<table>
<thead>
<tr>
<th>Climate Variable</th>
<th>Heat</th>
<th>Heavy Rain</th>
<th>Snow</th>
<th>Tropical Storm</th>
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<tbody>
<tr>
<td><strong>Power</strong></td>
<td>• Power Outages</td>
<td>• Catenary Damage</td>
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<td>• Sagging Wires</td>
<td>• Labor Demands</td>
<td>• Wire Failures</td>
<td>• Catenary Damage</td>
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<td>• Labor Demands</td>
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<td><strong>Buildings &amp; Bridges</strong></td>
<td>• HVAC Equipment</td>
<td>• Flooding Damage</td>
<td>• Slip &amp; Falls</td>
<td>• Flooding Damage</td>
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<td>• HVAC Equipment</td>
<td>• Pumping Demand</td>
<td>• Budget Demand</td>
<td>• Pumping Demand</td>
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<td><strong>Track &amp; Civil Engineering</strong></td>
<td>• Track Buckling</td>
<td>• Culvert Damage</td>
<td>• Downed Trees</td>
<td>• Washouts</td>
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<td>• Labor Demands for Inspection</td>
<td>• Washouts</td>
<td>• Labor Demands</td>
<td>• Debris</td>
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<td>• Speed Restriction</td>
<td>• Speed Restriction</td>
<td>• Broken Track</td>
<td>• Gate Damage</td>
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<td><strong>Signals &amp; Communications</strong></td>
<td>• Speed Restriction</td>
<td>• Signal Damage</td>
<td>• Signal Failure</td>
<td>• Signal Damage</td>
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<td>• Failing Switches</td>
<td>• Signal Damage</td>
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<tr>
<td><strong>Policy &amp; Administration</strong></td>
<td>• Labor Conditions</td>
<td>• Service Disruption</td>
<td>• Service Disruption</td>
<td>• Extensive Service Disruption</td>
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<td>• Slippery Platforms</td>
<td>• Disruption</td>
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</table>
RESILIENCY STRATEGIES UNDERWAY: CAPITAL

- SLOPE STABILIZATION
- RAISED SIGNAL HUTS
- TURNBACK OUTSIDE FLOOD ZONE
- EMERGENCY GENERATORS
Regional Power Outage Emergency Response Plan

**Task List - Operations Division**

- **BSS:**
  - Locate all of the trains in the BSS tunnel.
  - Communicate with Train Engineers about water levels in the tunnel.
  - Once all of the trains in the tunnel are located, start evacuating trains.
  - After a train is evacuated, the Train Engineer shall verify that the train is secure before leaving the train.
  - After all train evacuations are complete and the passengers are out of the BSS Tunnels, direct the SEPTA Transit Police to specific stations to lock them up for property protection.

- **MFSE:**
  - Locate all of the trains in the MFSE tunnel as well the elevated track.
  - Communicate with Train Engineers about water levels in the tunnel.
  - Once all of the trains are located, start evacuating trains. The evacuation of trains in the tunnel takes priority over trains on the elevated portions of the track.
  - After a train is evacuated, the Train Engineer needs to verify that the train is secure before leaving the train.
  - After all train evacuations are complete and the passengers are out of the MFSE Tunnels, direct the SEPTA Transit Police to specific stations to lock them up for property protection.

- **NHSL & Trolley Routes 101/102:**
  - Locate all of the trains on each line.
  - Once trains are located, start communicating with train engineers regarding the evacuation of the trains.
  - Commence evacuating trains on the NHSL & Trolley Routes 101/102.
  - After a train is evacuated, the Train Engineer must verify that the train is secure before leaving the train.
  - After all train evacuations are complete, send Revenue Services out to the stranded trains on the Trolley Routes 101/102.
  - Send Revenue Services out to the stranded trains on the NHSL, with the understanding that the terrain in the area may provide prevent Revenue Services from getting the cash boxes off the trains.

- **Trolleys:**
  - Locate all of the trains in the tunnels as well as street level.

- **Buses & Trackless Trolleys:**
  - Once all of the trains are located, start communicating with Train Engineers on evacuation of the trains.
  - The evacuation of trolleys in the tunnel has priority over the evacuation of other trains.
  - After a train is evacuated, then the Train Engineer needs to verify that the train is secure before leaving the train.
  - After all of the trolley cars are evacuated on street level track, communicate with Revenue Services on which trolleys to retrieve the cash boxes from.
  - Locate all of the buses and trackless trolleys.
  - Trackless trolleys can travel 60-75 miles on their backup Emergency Power Units, and should finish the current route that they are on and then return to their normal depot.
  - Send all available buses along RAD lines, NHSL, Trolley Routes 101/102, the BSS and the MFSE to help with moving evacuated passengers to places of refuge.

- **RRD:**
  - Locate all of the trains in the tunnel as well as the rest of the system.
  - Communicate with Train Engineers about water levels in the tunnel.
  - Once all of the trains are located then start evacuating trains.
  - Trains in the tunnel have priority over the other trains on the system.
  - Prep the six diesel engines for mobilization to recover stranded trains on the RRD. Make sure that each diesel engine is equipped with couplers and/or low bars.
  - After a train is evacuated, the Train Engineer shall verify that the train is secure before leaving the train.
  - Follow the running orders and rescue trains off of the RRD to the various yards along the RRD System.
  - After all train evacuations are complete and the passengers are out of the RRD Tunnels, direct the SEPTA Transit Police to specific stations to lock them up for property protection.
RESILIENCY STRATEGIES UNDERWAY: CAPITAL: THE SIMPLE THINGS

RAISED CURBS AT VENTS

STEEL PLATE REINFORCEMENT
RESILIENCY STRATEGIES UNDERWAY: CAPITAL: REMOTE MONITORING

SHARON HILL EARLY FLOOD WARNING SYSTEM
RESILIENCY STRATEGIES UNDERWAY: OPERATING & MAINTENANCE

- DILIGENT TREE-TRIMMING
- SANDBAGGING VENTWELLS
- STAGING FLEET IN HIGHER GROUNDS
- EMERGENCY RESPONSE TRACKING
RESILIENCY STRATEGIES UNDERWAY:
OPERATING & MAINTENANCE

PRE-STORM BRIDGE AND
CULVERT INSPECTIONS
Hurricane Sandy Relief Fund

SEPTA selected to receive $86,758,000

- Railroad Signal Power Reinforcement
- Ancillary Control Center
- Railroad Embankment Slope Stabilization
- Subway Pump Room Emergency Power
- Sharon Hill Line (MSHL) Flood Mitigation
- Manayunk/Norristown Shoreline Stabilization
- Jenkintown Area Flood Mitigation
DISASTER RELIEF APPROPRIATIONS ACT 2013
DISASTER RELIEF APPROPRIATIONS ACT 2013

7 PROJECTS, $115.7M $87M (75%) GRANT SYSTEM-WIDE IN SCOPE
Railroad Signal Power Reinforcement ($32.0 M)

- $42 MILLION TOTAL PROJECT COST
- UPGRADES TO SIGNAL POWER CABLES & MOTOR GENERATORS
- INSTALLATION OF NEW SIGNAL SUBSTATION AT DOYLESTOWN
- PROTECT AGAINST FAILURES CAUSED BY DOWNED BRANCHES
Subway Pump Room Emergency Power ($3.7 M)

- $5 MILLION TOTAL PROJECT COST
- ON-SITE POWER GENERATION SYSTEMS FOR WATER PUMPS
- PROTECT AGAINST LOCALIZED OR REGIONAL POWER OUTAGES
Ancillary Control Center ($9.0 M)

- $12 MILLION TOTAL PROJECT COST
- COMPREHENSIVE COMMUNICATIONS CAPABILITIES IN THE EVENT OF AN EMERGENCY
- STRATEGICALLY SITED AT LOCATION OUTSIDE OF CENTER CITY
Railroad Embankment and Slope Stabilization ($23.1 M)

- $25 MILLION TOTAL PROJECT COST
- STABILIZE KEY EMBANKMENTS ALONG REGIONAL RAIL
- GLENSIDE CUT ON SEPTA’S MAINLINE
- MEDIA CUT ON MEDIA/ELWYN LINE
Sharon Hill Line Flood Mitigation ($3.8 M)

- $5 MILLION TOTAL PROJECT COST
- PUMPED DRAINAGE SYSTEM FOR FLOODING AT UNDERPASS
- UNDERPASS FLOODS MORE THAN A DOZEN TIMES EACH YEAR
- 377 DAILY WEEKDAY BOARDINGS IMPACTED BY FLOOD EVENT
Manayunk/Norristown Shoreline Stabilization ($4.5 M)

- $6 MILLION TOTAL PROJECT COST
- STABILIZE 2.45 MILES OF EMBANKMENTS ALONG SCHUYLKILL RIVER
- DECREASE LIKELIHOOD OF WASHOUTS
- INCREASE SPEED OF RECOVERY AFTER FLOOD EVENT
Manayunk/Norristown Shoreline Stabilization ($4.5 M)

- DURING WASHOUT, 6 STATIONS AFFECTED
- JUST OVER 3,000 DAILY INBOUD/OUTBOUND RIDERS
- TERRAIN AND LOCATION OF STATIONS MAKES DIFFICULTY FOR BUSSING
Jenkintown Area Flood Mitigation ($15.0 M)

- $20 MILLION TOTAL PROJECT COST
- COMPREHENSIVE STUDY OF DRAINAGE PATTERNS
- NEW BOX CULVERT/RAINWATER DETENTION SYSTEMS
- REINFORCEMENTS TO BRIDGE 10.97
RESILIENCY PRIORITIES

NOT JUST SGR – LONG-TERM RESILIENCY IS KEY

• High-Priority Projects:
  – Back Up Power
  – Relocated Railcar Storage
  – Drainage Improvements
  – Slope/Embankment Stabilization

• Immediate Benefits to Operational Reliability
QUESTIONS?

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